in Grace and Young's "Algebra of Invariants," where the invariants and covariants of a binary cubic are interpreted in terms of the geometry of the skew cubic. This is now remedied by Mr. Wood's tract, which discusses the subject *ab initio*. The first section deals with the projective properties of the curve, developed analytically with the use of homogeneous coordinates, and the second is specially concerned with the cubical hyperbola (the case in which the curve has three real and distinct points at infinity), and discusses the properties of asymptotes, diameters, vertices, centre, axis, inscribed and circumscribing quadrics, the rectangular cubical hyperbola, etc. No one who is interested in geometry can fail to appreciate the collection of properties which Mr. Wood has made, and many will, no doubt, be encouraged by the way in which the initial stages have been simplified, to pursue the subject beyond the limits which space has here rendered necessary.

(4) The purpose of this book is to supply the theoretical basis upon which graphical methods rest, and to discuss in general terms the manner in which applications may be made to shorten the labour involved in the heavy computation with which the physicist and engineer are so often faced. In many cases special graphical methods have been invented to cope with a particular kind of problem, and in view of the fact that there is little inter-communication between those working in different spheres, the opportunity of making use in one department of a device that has been of value in another is often missed, on account of the failure to recognise the generality of the principle which has been employed. The subject-matter is divided into three sections: the first deals with graphical arithmetic, the evaluation of integral functions, and the treatment of complex quantities; the second with the representation of functions of one or more variables, the principle of the slide rule, and the idea of conformal representation; and the last with the calculus and the solution of differential equations.

(5) This course of pure mathematics is most distinctly a lower limit of the equipment every scientific student should possess. The ideas of the calculus are at last beginning to find their way into the ordinary curriculum, more rapidly on the Continent than in England, and the time cannot be far distant when it will be impossible for boys who specialise in chemistry or physics to leave school ignorant of infinitesimal methods. The book deals with revision of arithmetic, algebra, geometry, and trigonometry; graphs of functions; differential and integral calculus, with special reference to expansion in series; and differential equations. The sections of the calculus make rather dull reading, little indication being given of the nature of the applications that it permits. The systematic treatment of what may be called the grammar of the subject should, however, enable the reader to acquire some degree of facility in performing ordinary operations.

(6) What is the criterion that distinguishes the theory of numbers from other branches of analysis? To this question, M. Cahen makes the following reply:—"The Theory of Numbers is a science in which division is *possible* only in special cases, whereas elsewhere division is *impossible* only in special cases." And this statement gives in brief the limits he has set himself in this treatise. The first eight chapters deal with addition, multiplication, subtraction, and divisions of integers, H.C.F. and L.C.M., and fractions; the next four with systems of diophantine equations of the first degree; then follow chapters on linear substitution and groups, linear and bilinear forms, congruences, matrices, prime numbers.

The treatment is thorough in character, and the work is set out so clearly that no student, however small his previous knowledge may be of the theory of arithmetic, should find it difficult to follow the argument; and if he reads through this volume carefully and tests his progress by working out some of the examples provided, he should obtain a firm grasp of this important modern subject. Text-books such as these form an admirable preparation for the student who wishes to make a more specialised study of the subject, for, by giving him a sound groundwork, they make it possible for him to consult intelligently the original memoirs which mark the growth of the theory, and which no text-book, however comprehensive, can in reality replace.

OUR BOOKSHELF.

Dental Diseases in Relation to Public Health. By Dr. J. Sim Wallace. Pp. viii+90. (London: Office of *The Dental Record,* 1914.) Price 3*s.* net.

This book consists of three chapters. They are addresses given by the author in "response to requests." Chap. i. sets forth in detail the prevalence of dental diseases, the serious effects they exercise on general health—especially during childhood—and the methods by which such diseases may be prevented. There are, however, within its pages statements based on loose figures, which are calculated to mar the effect the writer has in view by causing an impression of exaggeration of unverified inference. On the strength of the statement—itself too wide a generalisation—that 75 per cent. of the total population have irregularities of the teeth, we have presented to us the wild statement that "the number of teeth

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which are pouring pus into the buccal cavity may be estimated, at least has been estimated, at 200,000.000."

Chap. ii. contains a fairly wide description of the function of mastication, and of the effects of saliva on various foods. Chap. iii., on "Children and Dental Disease," is to a large extent a repetition of parts of chap. i., but clothed in different language.

We do not consider these chapters are a serious contribution to the literature of public health. Careful perusal of them impresses upon us the conclusion that, while condemning physiologists and medical men for their shortcomings in dental hygiene, the author is unduly confident in his own exaggerated and unbalanced opinions. He recommends prevention of dental disease by methods of dieting, which "show beyond all doubt that dental caries is not only preventable, but that it is easily and surely preventable."

The enormous benefit bestowed by early treatment as a method of prevention is not admitted by the author, who asserts that, "compared with modern methods of prevention, however, treatment must be regarded as a failure." He is equally clear that sugar should not be regarded as a wholesome and cheap food for children, but as a large and important factor in the production of dental caries. In these opinions we doubt if many physiologists will join him.

Savants du Jour: Albin Haller, Biographie, Bibliographie Analytique des Ecrits. By Ernest Lebon. Pp. 120. (Paris: Gauthier-Villars; Masson et Cie., 1913.) Price 7 francs.

There is something to be said for the publication of a man's biography during his lifetime. He is at least able to participate in the pleasant things that are said of him. Mr. Ernest Lebon has undertaken the task of writing the lives of the "Savants du Jour," and so far he has completed seven, the latest of the series being the life of Prof. Albin Haller. Son of a joiner and cabinet-maker, of Thaun-St.-Amarin, in the Vosges, Haller was apprenticed to a local apothecary until the outbreak of the Franco-German War, when he served as hospital assistant. At its conclusion in 1871, he left his native town to follow the fortunes of his teacher, M. Gault. When the staff of the Strasburg University was transferred to Nancy, Haller entered as a student of pharmacy, and in 1873 became lecture assistant in chemistry. He quitted the school of pharmacy in 1884 in order to fill the chair of chemistry. He was elected corresponding member of the Academy of Sciences, in 1891, and in 1899 was asked to take the chair vacated by the death of Prof. Friedel as professor of organic chemistry at the Sorbonne. In 1911 he was made commander of the Legion of Honour, and since then he has received widespread recognition by native and foreign scientific bodies.

His principal researches are mainly in the domain of organic chemistry.

In connection with his studies in the camphor group, he not only obtained a great variety of new and interesting derivatives of camphor and borneol, but among them the homologue of camphoric (homocamphoric) acid, which on distillation of its lead salt gives camphor, and in this way he succeeded in effecting a partial synthesis of camphor. The long list of researches which have emanated from his laboratory, in addition to his numerous literary contributions on scientific subjects, give evidence of an unusually active and fruitful career.

J. B. C.

A Course of Practical Work in the Chemistry of the Garden. By D. R. Edwardes-Ker. Pp. 40. (London: John Murray, 1914.) Price 1*s*. 6*d*. net.

One of the results of the foundation of a diploma in horticulture by the Horticultural Society is certain to be an improvement in the method of education of horticultural experts. The number of appointments in this direction tends constantly to increase, and now that the Board of Agriculture has established a horticultural branch, the competent expert finds the possibility before him of a highly successful career. In order to meet the demand for text-books that is certain to arise, Mr. Edwardes-Ker has collected a set of experimental lessons to be carried out in a chemical laboratory, and requiring only such limited knowledge of chemistry and of manipulation processes as will be available in the circumstances.

The book is divided into four chapters, headed respectively, "The Chemistry of Plants," "The Chemistry of Soils," "The Chemistry of Manures and Fertilisers," and "The Chemistry of Sprays and Washes." The experiments are simple and well chosen, and should prove of distinct value both to the student and the teacher. They will, of course, require to be supplemented by a suitable series of lectures setting forth the bearing of the facts thus ascertained on the growth of plants, and, in order to bring this out more clearly, we should like to see some pot experiments added. Pot experiments can be made quite simple enough for the purpose, and satisfactorily demonstrate many important phenomena that laboratory exercises alone can never bring out.

A Practical Manual of Autogenous Welding (Oxy-Acetylene). With a chapter on the Cutting of Metals with a Blowpipe. By R. Granjon and P. Rosemberg. Translated by D. Richardson, Pp. xxii+234. (London: C. Griffin and Co., Ltd., 1913.) Price 5*s*. net.

Autogenous welding consists in uniting metals by fusion without the intervention of solder. Ordinary welds may be effected by heating in a forge, but the local application of heat by an electric current or by the heat of an intense flame is more properly called autogenous welding in contradistinction to the junction of metals made by solder. The work before us treats of welding as done by the oxy-hydrogen and oxy-acetylene blowpipe, the introductory matter on soldering and electric welding being outside the main purpose of the work. The oxy-hydrogen weld was used before oxy-acetylene, but the latter is now the most

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